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ABSTRACT

As part of the Stanford Curriculum Study, information is provided on the university's approach to monitoring undergraduate education through research into student academic records. Trends in bachelor's degrees granted in the various departments from 1960-1961 to 1981-1982 at Stanford are charted and compared to national trends. Course enrollments are also examined, along with policy implications of the results. Data were obtained for the following six school divisions: School of Earth Sciences, the School of Engineering, and four divisions within the School of Humanities and Sciences--humanities, natural sciences, social sciences, and interdepartmental programs. Looking at the 7 years covered by the Curriculum Study (after 1975), significant declines for numbers of bachelor's degrees granted were found in three school divisions (humanities, social sciences, and natural sciences), and large increases in the other divisions (interdepartmental programs, engineering, and earth sciences). Although the humanities, social sciences, and natural sciences experienced a decrease in graduates in recent years, none of these divisions suffered losses in their overall course enrollments. Enrollments in the interdepartmental programs and engineering departments increased. (SW)

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DEGREES GRANTED AND COURSE ENROLLMENTS BY FIELD OF STUDY

Second in a Series About the Stanford Curriculum Study

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DEGREES GRANTED AND COURSE ENROLLMENTS

BY FIELD OF STUDY

ABSTRACT

As part of a series on the Stanford Curriculum Study, this article illustrates Stanford's approach to monitoring undergraduate education through research into student academic records. Trends in bachelor's degrees granted in the various departments at Stanford are charted and compared to national trends. Course enrollments are also examined. Policy implications of the results are discussed.

DEGREES GRANTED AND COURSE ENROLLMENTS BY FIELD OF STUDY

Second in a Series About the Stanford Curriculum Study

In the first article in this series [1] we discussed the history and methodology of the Stanford Curriculum Study, a longitudinal investigation of the academic records of graduating Stanford seniors. The Curriculum Study concentrates on the majors students choose, the courses they take, and their academic performance at the university. The primary goals of the project are (a) to produce systematic and reliable information about what undergraduate students actually do so that policy discussions will be better informed, and (b) to provide an accessible and complete data base that can be used as needed for research into particular issues concerning undergraduate education. Now in its eighth year, the Curriculum Study has proven to be a useful tool for the improvement of undergraduate education at Stanford.

In this and two subsequent articles we will examine curricular issues of particular importance in today's university environment. Our primary goal is to demonstrate the usefulness of the type of analysis represented by the Curriculum Study, but we also present research findings that are of substantive interest in their own right.

The issues we address in this article are the following:

(1) The distribution of degrees granted by major field of study. At Stanford, as well as nationally, there have been substantial changes in the popularity of different undergraduate major programs. These changes place considerable strain on both the departments that are gaining students and those that are losing them.

(2) Course enrollments by academic department. One of the possible consequences of a rising or declining number of students majoring in a given

department is a corresponding change in the volume of enrollments in the department's courses. As we shall see, however, there is no direct relationship between the number of majors and the level of course enrollments.

(3) The sources of course enrollments by academic department. An important variable complicating the relationship between the number of majors and the level of course enrollments is the sources of enrollments in a department's courses. Here the issue is the share of a department's enrollments accounted for by its own majors as compared to the share accounted for by students from outside the department.

Most of the data we present in this article is taken from what we call the "school division" level of analysis. A school division is a group of academic departments that have a shared disciplinary emphasis. The six school divisions used here are the School of Earth Sciences, the School of Engineering, and four divisions within the School of Humanities and Sciences: humanities, natural sciences, social sciences, and interdepartmental programs. We will also use data from individual departments in order to show the kinds of concerns that can be addressed at a finer level of analysis.

BACHELOR'S DEGREES GRANTED AT STANFORD

A. Methodological Considerations

The most important consideration in assessing changes in the distribution of degrees granted is the necessity of setting the changes into an appropriate context. We provide two contextual settings for the Stanford data on degrees granted. The first is temporal: in examining major choice, we use data for a 20-year period. This allows us to put the changes evident in the Curriculum Study (whose data begin in 1976) into perspective so that we know whether we are observing long-term trends or only temporary fluctuations. Changes over a

period as short as seven years can be misleading, especially with respect to departments that have rather few graduates or departments that have previously undergone considerable growth or decline. By using a longer time span, mistakes of interpretation are minimized.

The second setting concerns the larger population to which the university compares itself. In order to interpret changes in one institution, it is important to know the extent to which these changes are consistent with national or regional trends. If changes are in the same direction at both the local and the larger level, one can infer that the impetus to change is largely external to the institution and subject to only limited control by the institution. If, on the other hand, changes at the local level are contrary to changes at the larger level, there is good reason to suppose that local policies and programs are responsible for them.[1]

A final methodological consideration is the necessity of making comparisons based on the percentages of all degrees granted rather than the absolute number of degrees (unless the total number of degrees granted by the university is very stable or the number of degrees in the academic unit under scrutiny is a very small proportion of all degrees). Percentage figures are a must during periods of rapid expansion or contraction, such as the explosive growth period of the 1960s and early 1970s.

B. Degrees Granted by School Divisions

Information on the degrees granted by school divisions is presented in Figure 1, in which the importance of using a long period in assessing changes in the distribution of degrees becomes clear. Looking at the seven years covered by the Curriculum Study (after 1975), we find significant declines in three school divisions (humanities, social sciences, and natural sciences) and large increases in the other divisions (interdepartmental programs,

engineering, and earth sciences). However, when the full series of data on degrees granted since 1961 is examined we find that most of the trends of the late 1970s look rather different.

The decline in the humanities began as far back as 1966-67; prior to that time, this division had been growing rapidly. Although by 1981-82 the humanities had reached an unprecedentedly small share of all degrees, the decline seems somewhat less severe when compared with the figures for 1960-61 before the expansion in the humanities began. The decline in the social sciences began in 1970-71, also from a very high percentage of all degrees. The social sciences recovered slightly in the middle years of the 1970s and then dropped rapidly after 1974-75. Even after several years of decline, however, by 1981-82 they had fallen only slightly below the level of 1960-61.

For the natural sciences we find only a marginal decline over the longer term. The peak percentage in 1975-76 was somewhat exceptional; the natural sciences accounted for about 14 to 15% of all degrees throughout the two decades, and the percentage of degrees granted between 1976 and 1982 was quite typical of the period as a whole.

Turning to the school divisions showing growth over the recent period, we see that in two cases (interdepartmental programs and earth sciences) the expansion was historically unique. Interdepartmental programs, having been founded only in the later 1960s, attracted very few students before 1971-72 but their growth after that point was remarkable. Expansion in the earth sciences began about the same time and did not subside until 1980-81. Engineering followed the inverse pattern from that of the humanities and social sciences: after a long period of decline to only 6.1% of degrees granted in 1973-74, it rose quickly in the latter 1970s to its present level of over 16% of all degrees. By 1981-82, however, it still had not recovered to the level of 1960.

Dramatic changes such as these provoke two key questions: Why have such changes occurred? How should the university respond to them? We will leave consideration of the first question to a later section. As for the second, let us consider the issue in more concrete terms, using engineering as an example. First, it is important to bear in mind that the number of degrees granted tells only part of the story regarding a department or school division's student load; degrees in engineering can decline while enrollments in engineering courses remain steady, and degrees can remain steady while course enrollments decline. Because faculty teaching loads are much more closely related to course enrollments than to the number of undergraduate majors, trends in the former must be examined before sounding the alarm for particular divisions.

If, however, it becomes clear that engineering is losing both majors and enrollments, policy questions become unavoidable. Should the university freeze faculty hiring in engineering because of the decreasing student load? If it does so the breadth and strength of the engineering departments may be diminished, but if it does not do so the rest of the university must "carry" engineering during the lean years. On the other hand, if cuts in engineering are made the university will be unprepared for a resurgence of interest in engineering and may find itself facing a shortage of first-rate engineering professors in the academic job market, as has recently been the case. The situation is further complicated at research universities like Stanford where faculty responsibilities include graduate teaching and research. Even if there is a declining number of graduate students at the same time that undergraduate majors and enrollments are decreasing, the very existence of the graduate program severely limits the university's flexibility in adjusting to declining student demand for engineering because the program requires a

diversified faculty. And, of course, the degree of flexibility the university can exercise in adjusting to changing student demand is inversely related to the proportion of the affected faculty that is tenured.

C. Degrees Granted by Department

Interpreting the trends in degrees granted among the school divisions is possible only by studying changes within these divisions. We have selected two of the six school divisions as examples, the social sciences and the interdepartmental programs. Data on degrees granted by the departments in these divisions are presented in Table 1.

The social sciences generally followed a pattern of growth in the 1960s that peaked in the early or middle 1970s and then yielded to a decline. Anthropology best typifies the general pattern, growing rapidly up to 1972-73 and then dropping sharply to end the period about where it began. Psychology also had a very steep rate of increase followed by a sharp decrease, while political science followed a more moderate course and sociology (for the period as a whole, the smallest department) had a more volatile history. There were two exceptions to this pattern, communication and economics. Communication showed almost monotonic growth through 1976-77, after which time it tapered off slightly; while economics had a fairly constant but highly variable percentage of degrees until 1973-74 after which it experienced massive growth. By the end of this period, economics was granting more bachelor's degrees than any other department in the university.

It is clear from this discussion that it was not the social sciences per se that lost students at Stanford; rather, it was those social science departments that did not provide fairly immediate access to occupations in demand among students. Both communication, with its ties to careers in journalism, film and broadcasting, and economics, which leads to a host of careers in the business world, fared quite well.

The interdepartmental programs granted very few degrees before 1971-72. Only one of the programs (Latin American Studies) existed before the late 1960s, when the human biology and mathematical sciences programs were founded. These latter programs enjoyed dramatic growth in the early years of their existence and then settled down to plateaus of about 160 and 25 degrees per year, respectively. The human language program resulted from the alteration of the linguistics major to an interdisciplinary endeavor of broader scope. In the late 1970s two additional programs, American studies and international relations, were added, and both of these followed the same pattern of very rapid growth.

Why have the interdepartmental programs proven so attractive? We believe that their drawing power at Stanford depends not just on their inherent substantive interest but on two more tangible factors as well: the participation of professors with reputations as outstanding teachers and the perception of the programs by students as offering attractive vocational opportunities. Human biology provides an appealing alternative to biology and chemistry for pre-medical students. It requires less coursework in the natural sciences and mathematics and offers a broader education in the social sciences and humanities instead. Similarly, international relations is an alternative to history and political science (though relying primarily on these two departments for its courses) as a broadly based major suitable for students interested in pursuing law or business careers.

If this reasoning is sound we would expect that biology, history, and political science were losing students in the latter half of the 1970s as the interdepartmental programs expanded. This was indeed true of biology and history (bottom of Table 1), though it is clear that the decline in history was part of a long-term trend that began much earlier. It was not true of

political science, however, which lost students before international relations was organized in 1973 and awarded a largely constant number of degrees later. The latter finding suggests that the success of international relations must have been due to other factors, among which we can name the generally increasing awareness of and interest in international issues of all sorts over the past fifteen years.

At Stanford the usual response to changes in student interest in the various departments has been a "wait and see" attitude for departments suffering a loss of students. Departments that are gaining students, on the other hand, have been favored in the allocation of new faculty positions to help them meet the demand. In some cases, however, the affected departments have themselves felt that they were attracting an inordinately large share of the undergraduate population and have stiffened their major requirements in order to stem the tide rolling in their direction. This was true, for example, of the economics department in the late 1970s. The university prefers not to take broader action to control students' choice of major, such as admitting students only for specific majors or allowing departments to set ceilings on the number of students who may major in their programs. While such measures might increase the predictability of student load in the various departments, the university feels that they unduly restrict students' opportunity to explore options and select majors that suit them best.

NATIONAL TRENDS IN DEGREES GRANTED

A deeper understanding of the trends at Stanford requires consideration of the larger context in which the changes have occurred. Table 2 presents national data on degrees granted, showing the percentage of all degrees for selected disciplines over the fifteen years from 1965-66 to 1979-80 (the latest year available) accompanied by the Stanford data.

The national data are compiled by the National Center for Education Statistics (NCES) through their Higher Education General Information Survey (HEGIS). Since 1965-66 NCES has surveyed the complete population of degree-granting institutions in the United States, with a response rate at or very near 100% each year. Hence the data have a very high degree of validity. For more information about the conduct of the survey, see [3].

In looking at the data in Table 2 we note first the very rapid rise in the total number of degrees, from slightly over one-half million in 1965-66 to a peak of just under one million in 1973-74. This decade was the period of greatest growth in higher education in U.S. history. The growth at Stanford over this period was more modest, about 250 degrees or 18%. The stability over the past decade at Stanford is the result of a policy decision made in the late 1960s to put an end to the steady expansion of the undergraduate population that had been in progress for years.

To what extent, then, do trends in major choice at Stanford parallel those for the nation as a whole?

To begin with the humanities departments, the decline in history at Stanford was quite consistent with the national trend, although more dramatic. History degrees in the U.S. peaked in 1968-69 at 5.6% of all degrees and then plummeted sharply, to 2.1% in 1979-80. The decline at Stanford was from a high of 20.8% of all degrees to only 4.7% in 1979-80. In English and foreign languages the national patterns were similar to history: after a period of growth lasting until the late 1960s, these disciplines dropped rapidly to well under half their peak percentages. The trends at Stanford were similar except that for languages at Stanford, it was only in recent years that a marked drop in degrees occurred.

For the fine arts, degrees at Stanford peaked in the 1971-73 years and then fell moderately. The data at the national level are not comparable over the entire period, as the disciplines included in the fine and applied arts were changed in 1970-71. For the recent decade, though, the pattern closely matched the Stanford trend.

Overall, then, there was a severe decline at both Stanford and in the nation in humanities degrees. Given the growing concern for occupational success that characterized the 1970s, this decline was probably due mostly to the widespread perception that humanities degrees lead to limited occupational prospects. In addition, the severe over-supply of public school teachers during the 1970s contributed heavily to the move away from the humanities.

For the social science disciplines the patterns at Stanford and at the national level were on the whole also very similar. Four departments at Stanford declined from peaks in the early 1970s: anthropology, political science, psychology, and sociology. At the national level, the respective disciplines peaked at about the same time, except for political science. The remaining Stanford social science disciplines, communication and economics, gained students over the long term. The national pattern for communication differed somewhat from that at Stanford in that there was steady growth even in the late 1970s. In economics the national pattern was even more at variance with the Stanford cycle: national degrees peaked in 1967-68 and then declined gradually until 1973-74, recovering somewhat thereafter; at Stanford the figures were largely constant until 1974-75 and then increased very dramatically.

Declines in the social sciences (except economics and communication) probably were due to the changing political culture of American society as much as to their perceived inadequacy for occupational success. Students

entered the social sciences in the 1960s as part of the wave of political reevaluation and reorientation that swept the campuses and much of the rest of society. The exhaustion of that movement led to the decline in interest in sociology and anthropology in particular -- understanding and changing society was no longer a top priority for students. The rise and fall of psychology degrees was similarly due largely to broad cultural changes. The early 1970s saw the rise of a variety of movements having to do with personality development and self-enhancement, and one of their manifestations was the undergraduate study of psychology. As this inward-oriented self-examination gave way to careerism in the latter half of the 1970s, psychology became a less desirable field of study. The increases in communication and economics, however, fit the general thesis that students sought more vocationally-oriented majors in the late 1970s.

In the natural sciences there is more difficulty in comparing trends at Stanford with the national patterns because most of the Stanford departments awarded relatively few degrees. For the one large department, biological sciences, the Stanford pattern showed very considerable growth in the 1960s that continued until 1975-76. Thereafter there was a fairly sizeable decline. At the national level we see precisely the same trend. The national patterns in chemistry, mathematics and statistics (combined), and physics were quite different: all of these disciplines declined over our period. Mathematics at Stanford suffered a similar decline, but chemistry and physics fared better at Stanford than at the national level.

The expansion of biology can be explained by the great increase in student interest in medicine, while the national decline in chemistry and physics was due to the shift to biology and, perhaps, to the decline in mathematics competence of college students [2]. For mathematics itself the

main problem was the decline in demand for elementary and secondary school teachers. Stanford's chemistry and physics departments were able to resist decline because their students have always been very successful in gaining admittance to highly regarded graduate schools.

Regarding the interdepartmental programs the national patterns were mixed: in American studies and international relations there was very little change over the period, while in linguistics (the equivalent of the human language major at Stanford) there was great growth. For all of these programs, however, the absolute number of degrees awarded was very small indeed. Stanford was thus very atypical in that a significant proportion (about 15%) of its graduates in recent years received interdepartmental program degrees.

Most of the engineering departments at Stanford -- chemical, civil, electrical, and mechanical engineering -- duplicated the national trends fairly faithfully. The cycle was a decline in the 1960s followed by recovery in the latter 1970s, and even the timing of the changes was similar at the two levels. On the other hand, in general engineering the Stanford department had a fairly stable number of graduates, while at the national level there was slow but steady growth. For industrial engineering the national decline to a low point in 1975-77 was followed by only very modest recovery, while at Stanford industrial engineering became a boom major in the late 1970s.

The earth science departments also followed the national trends very closely in an easily described process -- explosive growth in most areas. However, the expansion at Stanford was concentrated in the period after 1975 while at the national level it was spread out over the longer period.

The decline and eventual recovery in engineering areas was a major outcome of the general trend away from occupational concerns in the 1960s and

return to those concerns in the 1970s. Another factor was the anti-technology sentiment that grew out of the ecological awareness movement and did not begin to fade until the latter half of the 1970s. To some extent it became "unpopular" to be an engineer for some years. The great expansion of earth science fields was a direct result of increasing demand for knowledgeable technicians in the energy industry, with a special boost stimulated by the "oil crunch" of the early 1970s.

We have tabulated the comparison of trends in the nation and at Stanford in Table 3.[2] The top half of the table describes departments and disciplines for which national trends were closely followed at Stanford. The departments or disciplines that declined over our 15 year period are given first. For these departments the table gives the peak year or years after which the decline began. The second portion of the table gives analogous information for the departments or disciplines that grew in the 1970s.

The bottom half of the table describes areas in which the trends were not similar. We have given the benefit of the doubt to this section -- i.e., if the trends were only modestly similar or were similar for only a portion of the period, we have classified the department or discipline as dissimilar.

Changes in the distribution of degrees at Stanford conformed quite closely to those in the nation as a whole: for 16 cases the trends were similar and in only 7 cases were they dissimilar. Even the timing of the cycles was not very different for most of the cases where there were similar trends. There were sizeable differences for political science and mathematics; other differences were small and inconsistent. In looking at the areas where the patterns were dissimilar, we note that the only area in which there was a genuinely contrary trend was that of applied earth sciences. In other cases there was change at one level that was belied by more constancy at

the other level.

This discussion shows that in general the shifts in the distribution of degrees granted at Stanford were very similar to those in the nation as a whole. To a large degree, then, the sources of the shifts must be seen as lying outside the Stanford environment itself. This implies that these sources are not subject to control by the university, a very important finding for policy considerations. In the present case, the university must recognize that extraordinary effort would be required to reverse or even halt the trend among its students toward occupationally-oriented programs because large social forces are producing it. On the other hand, if the trend toward certain majors at the expense of others is viewed as undesirable the university can take advantage of the findings of an analysis such as this to adapt to and "co-opt" the social forces producing the change. A good example is provided by the Department of Sociology. In the mid-1970s, as it became clear that occupational concerns were becoming paramount in students' major choices, the department dressed up its curriculum to make the occupational possibilities of a sociology degree more visible and attractive. This effort halted the decline in sociology degrees and even reversed the trend somewhat. The extent to which such efforts can succeed is limited but not negligible.

ENROLLMENTS PER DEGREE RECIPIENT BY SCHOOL DIVISION AND DEPARTMENT

As pointed out earlier, evaluating changes in student demand for various disciplines or departments requires consideration of course enrollments as well as degrees granted. To facilitate comparison among academic units, we have found it useful to standardize enrollment figures by the number of degree recipients. Figure 2 plots the seven-year figures for the number of course enrollments per graduate in the six major school divisions at Stanford. The

humanities led the way with almost 13 enrollments per degree recipient; this figure indicates that the "average" graduate had completed thirteen courses in the humanities. The social and natural sciences followed with over nine enrollments per student, with the remaining divisions accounting for relatively few enrollments. These three smaller divisions, however, experienced considerable growth over the seven years, earth sciences and the interdepartmental programs by about 50% and engineering by over 100%. The natural sciences also showed some growth (27%) while figures for the humanities and social sciences were nearly constant.

Given stability in the humanities and sciences and growth in the other school divisions, the total number of enrollments per student increased by a good margin -- from 35.3 to 42.0 enrollments per student, or about 19%. Much of this increase was accounted for by engineering (2.73 enrollments per student), a result of the great growth in engineering majors over the period. Engineering students have considerably more enrollments per capita than students majoring in other areas because nearly all engineering courses are offered for only three units while many courses in the humanities and sciences yield five units of credit.[3] The average engineering student needs to take more courses in order to accumulate the 180 units required for graduation; thus, as the proportion of students majoring in engineering increases, so does the average number of course enrollments.

Figure 2 casts an interesting light on the changes in degrees granted discussed earlier. Recall that the humanities, social sciences, and natural sciences experienced a decrease in graduates in recent years. Yet none of these divisions suffered losses in their overall course enrollments per student: despite the shift to engineering and earth science degrees, students enrolled in about the same numbers of humanities and social science courses as

they had previously and took even greater numbers of natural science courses. The stability in the humanities and social sciences reflects the fact that these school divisions lost students primarily to the two interdepartmental programs showing rapid growth over our period, international relations and American studies. These programs rely heavily on humanities and social science courses. And the modest increase in natural science enrollments itself resulted from the growth in engineering majors, as these students take a large number of such courses.

Moving to the departmental level of analysis, Table 4 presents information on the enrollments per student in the larger departments and programs at the university, as well as figures for a few smaller departments that showed appreciable changes. There was considerable change at the departmental level, led by the engineering departments with gains of 50-150%. Some other departments increased by more than one-third (human biology, 50%; political science, 40%; physics, 35%), while decreases of one-fifth or more were suffered by psychology (25%), biology (21%), and music (20%). Most of the larger changes identified here can be fairly readily explained in terms of shifts in the numbers of students majoring in the respective or related areas; the increase in engineering enrollments is the most obvious example. The increases in political science and physics were due to increases in the numbers of students majoring in international relations and engineering, respectively, while the decreases in psychology and biology were due largely to the declining numbers of psychology and biology majors.

The shifts in enrollments, however, were not as pronounced as those in major choice. In history, the number of graduates fell from 129 to 72 (44%) over the seven years, but history enrollments declined by only 9%. Similarly, while psychology lost about 57% of its degree recipients its course

enrollments declined by only about 25%. In fact, the only department suffering sharp declines in both graduates and enrollments per student was biology. In some other cases a decrease in majors was in fact countered by an increase in enrollments per student. For example, in mathematics enrollments per student increased 27% while majors were declining from 17 to 10. Such contrary trends are possible only in departments whose courses were taken primarily by students not majoring in the department.

To summarize, the most important outcome seen here is that the shift toward engineering and occupationally-oriented majors did not greatly damage the ability of departments in the humanities and social sciences to bring students into their courses. Rather, these school divisions managed to hold their own (or better) while enrollments in the interdepartmental programs and engineering departments increased.

From a policy standpoint these findings are on the whole reassuring. They reveal that the fashions among students in their choice of major are relatively superficial phenomena. At the underlying level of course choices, changes are less dramatic and worrisome. But they also show that some departments, particularly large ones such as psychology and biology whose own majors account for large proportions of their enrollments, are subject to the loss of significant numbers of both enrollments and majors. Because national enrollment data are not compiled, there is no way to investigate whether enrollment changes are (like changes in degrees granted) subject to society-wide influences or are more local in origin. Assuming that they are of local origin and subject to local influences, the university needs to monitor factors that are under its control - teaching quality, curriculum, physical facilities, staffing, and so on - with special attention to the departments in which declines occur. If the declining departments appear to be doing their

jobs as well as ever, there is little choice but to wait for the tide to change. If not, efforts toward improvement are in order.

SOURCES OF COURSE ENROLLMENTS

As already noted, an important element in understanding variations by department in enrollments per degree recipient is knowledge of where the students who take courses in the various schools or departments come from. Some schools and departments serve primarily their own majors; their enrollments are thus largely determined by the number of majors they attract. Others act more as "service" units that draw students mostly from other departments; enrollments in these departments are less likely to change rapidly. In this section we look at the percentages of course enrollments in the four largest school divisions accounted for by students majoring in each of the six divisions, e.g., the percentage of enrollments in the social sciences accounted for by students majoring in the humanities, engineering, the social sciences themselves, and so on. We omit enrollments in interdepartmental and earth science courses.

Figure 3 provides this information. The figures show the sources of enrollments for 1975-76 and 1981-82. The percentages of enrollments accounted for by a school's own majors ranged from a high of 76% for engineering courses to lows of 34% in the natural sciences and 35% in the humanities. In other words, the School of Engineering drew students mostly from its own majors, while the humanities and natural sciences served students mostly from other areas. The social sciences fell in between.

These results are quite sensible. Engineering courses are more specialized and technical in nature than those of any other school division, so they tend to attract engineering students primarily. Further, engineering majors are <u>required</u> to take a relatively large proportion of their coursework

within the Engineering School. Social science courses are less specialized, but the fact that this school division has such a large number of majors explains the relatively large proportion of enrollments accounted for by its own students. Humanities and natural science courses, on the other hand, offer many courses that are required of or of interest to a broad range of students.

Only two trends are evident in Figure 3, and both of them are directly related to the changes in the distribution of degrees granted across the schools. First, the percentage of course enrollments accounted for by engineering majors increased in all school divisions. Second, enrollments accounted for by humanities, natural science, and social science students decreased to some extent across the school divisions. Humanities students, for example, were responsible for 44% of humanities enrollments in 1975-76 but only 35% in 1981-82, a decline of about 20%. This decline can be contrasted with a 29% drop in humanities graduates over the period (from 392 to 292), indicating that humanities students must have increased their degree of concentration within their own school division to some extent. The shares of course enrollments taken by both natural science and social science students also decreased for most school divisions; these declines corresponded to losses of degree recipients by these school divisions.

In contrast to the stability and regularity of the data regarding course-taking by school division, the sources of enrollments at the departmental level were much more volatile and trends are harder to identify due to large year-to-year fluctuations in many departments. It is nonetheless important to examine the sources of enrollments at the departmental level to see if there are exceptions to the findings at the school division. For example, in humanities departments at Stanford (which generally are "service" departments)

students from outside the humanities accounted for between 48% (Classics) and 68% (Spanish and Portuguese) of enrollments, a fairly considerable range. Classics was thus much less oriented to outside majors than was Spanish. An even more extreme example can be found in the natural sciences, where the division's own majors accounted for fully 65% of biology enrollments but only 12% of statistics and 22% of mathematics enrollments. Clearly enough, biology served mostly natural science students (most of whom were biology majors) while mathematics and statistics had a much broader clientele.

The importance of monitoring the composition of course enrollments in this way should be clear. A department that is losing majors but not enrollments may be filling the enrollment gap by attracting students from other majors. On the other hand, the department's majors may be concentrating more of their coursework within the department, perhaps in response to internal factors (the department has increased its major requirements) or perhaps in response to external factors (e.g., biology majors are taking more biology as the competition to enter medical school increases). The former case indicates a successful adaptation to declining popularity as a major, but the latter does not and bodes poorly for the department's long-term enrollments. The same type of reasoning can be applied to the case in which a department is losing enrollments but not majors, an acceptable situation if most of its enrollments come from outside the department but a problematic one if the department's own majors are taking fewer courses within the department. Somehow the department's courses are failing its own students.

SUMMARY AND CONCLUSIONS

In this article we have examined changes in degrees granted and course enrollments at both an aggregate (school division) and detailed (departmental) level. We have found that the large shifts in degrees granted at Stanford are

mostly parallel to national trends, suggesting that the shifts are caused by factors external to the university and are therefore relatively difficult to control. On the other hand, changes in course enrollments are much more moderate than the changes in degrees granted, and course enrollments have not declined even in school divisions that have lost a large percentage of their major students. At the departmental level we have found that an important factor intervening in the relationship between degrees granted and course enrollments is the proportion of enrollments accounted for by the department's own majors. Course enrollments in "service" departments are not greatly affected by changes in the distribution of degrees, but enrollments in departments that serve primarily their own majors are.

For policy considerations the types of changes studied here are of great importance. The university needs to be aware of such changes and have an understanding of why they are occurring in order to respond to them rationally. Knowing that changes in degrees granted are a national phenomenon keeps the university from "blaming" departments that are losing students. At the same time, the university can take steps either to resist or adapt to national trends and have some understanding of how effective they are likely to be. By monitoring course enrollments and relating them to degrees granted the university can distinguish between situations that represent fairly benign change (degrees are decreasing but enrollments are not) and those that may well indicate a coming crisis (where enrollments are declining as well). And, finally, longitudinal analysis that places short-term changes into historical perspective is a powerful aid in predicting the likely duration and intensity of current trends.

The analysis of degrees and enrollments is a major portion of the Stanford Curriculum Study, but it is by no means the sole focus of the

project. In our next article we will examine sex differences in undergraduate education, an issue of concern to all institutions of higher education in the 1980s.

FOOTNOTES

1. Data on degrees granted are publicly available at a low fee from the National Center for Education Statistics [3], which makes it fairly easy to track statistics for degrees granted for virtually any comparison population - national or regional - one chooses.

2. We have omitted from Table 3 departments at Stanford that had very few graduates each year as well as disciplines at the national level for which the number of degree recipients was so small that the Stanford figures were a significant proportion of all national degree recipients (e.g., human biology). We have also eliminated some of the interdisciplinary departments because they began granting degrees relatively recently at Stanford and long-term comparisons cannot be made (e.g., international relations and American studies).

3. The mean numbers of units of credit per course enrollment from 1976-77 to 1981-82 were as follows: engineering 3.11, natural sciences 3.46, earth sciences 3.91, humanities 3.93, interdepartmental 3.98, and social sciences 4.16. Over this period there was a modest increase in units per enrollment in the social sciences and engineering and a slight decrease in the humanities.

REFERENCES

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3. NCES (National Center for Education Statistics). Earned Degrees Conferred, 1979-80. Washington, D.C.: NCES, 1980.

TABLE 1

BACHELOR'S DEGREES GRANTED BY SELECTED DEPARTMENTS
1960-61 TO 1981-82
(percentages of all degrees)

	1960 - 61	1962 - 63	1964 - 65	1966 - 67	1968 - 69	1970 - 71	1971 - 72	1972 - 73	1973 - 74	1974 - 75	1975 - 76	1976 - 77	1977 - 78	1978 - 79	1979 - 80	1980 - 81	1981 - 82
Social Science Department																	
Anthropology	0.9	1.2	1.2	1.7	2.2	3.6	3.4	4.4	2.9	2.1	1.7	1.3	1.2	1.2	0.7	1.0	1.1
Communication	1.1	1.2	0.9	1.8	2.4	2.6	3.4	3.5	4.2	5.2	4.3	4.9	3.1	4.2	3.6	4.1	3.4
Economics	8.5	9.6	7.9	8.7	7.7	8.9	8.1	5.7	8.2	11.4	11.3	12.5	12.6	13.3	11.2	13.3	12.5
Political Science	12.3	12.6	11.7	9.1	12.1	10.7	9.3	8.5	7.1	6.8	6.6	6.7	6.6	5.7	7.3	7.2	6.5
Psychology	5.0	6.1	8.5	8.3	12.0	12.8	12.1	12.1	12.7	12.9	10.0	7.7	7.1	4.9	6.1	3.0	4.4
Sociology	2.4	1.2	1.2	1.6	1.9	2.0	2.4	1.5	1.2	1.2	0.8	0.6	0.7	1.3	0.9	0.9	0.7
Interdepartmental Programs																	
American Studies	-	-	-	-	-	-	-	-	-	-	0.1	0.5	1.1	1.5	1.8	1.5	1.3
Human Biology	-	-	-	-	-	0.1	4.5	7.3	10.0	8.5	7.8	8.8	8.7	10.0	9.0	10.7	11.1
Human Language	-	-	-	-	-	-	-	-	-	0.1	0.7	0.6	0.4	0.4	0.4	0.3	0.4
International Relations	-	-	-	-	-	-	-	-	-	-	0.9	1.3	2.9	4.3	4.7	4.0	5.1
Latin American Studies	0.1	0.6	0.6	0	0	0.1	0.1	0.2	0.2	0	0.2	0.2	0.2	0.2	0.1	0	0.1
Mathematical Sciences	-	-	-	-	-	-	0.2	0.8	1.0	1.5	2.3	1.3	1.6	1.5	1.5	1.4	1.4
Other																	
History	15.5	15.5	20.4	20.2	13.7	10.9	10.3	9.9	7.4	7.2	7.2	6.4	6.1	5.1	4.7	5.2	4.4
Biology	4.6	7.1	6.7	8.1	6.7	7.7	9.5	9.1	11.8	12.2	14.2	11.3	10.6	11.0	10.6	10.9	8.4
TOTAL DEGREES	1165	1284	1400	1486	1435	1489	1612	1691	1699	1607	1688	1653	1663	1620	1639	1583	1650

TABLE 2

BACHELOR'S DEGREES GRANTED, USA AND STANFORD,
1965-66 TO 1979-80
(percentages of all degrees)

	1965-66	1966-67	1967-68	1968-69	1969-70	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79	1979-80
Number of Degrees															
USA (thousands)	524.1	562.4	636.9	734.0	798.1	846.1	894.1	930.3	954.4	931.7	934.4	928.2	930.2	931.3	940.2
Stanford (units)	1430	1486	1492	1435	1443	1489	1612	1691	1699	1607	1688	1653	1663	1620	1639
Humanities Disciplines															
Fine, Applied Arts[1]															
USA	3.6	3.8	4.0	4.3	4.5	3.6	3.8	3.9	4.2	4.4	4.5	4.5	4.4	4.4	4.4
Stanford	3.5	3.7	3.2	3.6	4.4	3.8	5.1	4.8	4.1	3.2	4.3	2.9	3.7	4.3	3.5
Foreign Languages															
USA	2.9	3.0	3.0	3.0	2.7	2.4	2.2	2.1	2.0	2.0	1.7	1.7	1.4	1.3	1.2
Stanford	4.3	3.4	4.4	3.8	3.8	2.9	3.1	3.4	2.9	2.1	3.5	3.1	1.9	1.3	2.1
History															
USA	5.5	5.6	5.6	5.6	5.5	5.3	4.9	4.4	3.9	3.4	3.1	2.7	2.5	2.3	2.1
Stanford	20.8	20.2	16.7	13.7	13.4	10.9	10.3	9.9	7.4	7.2	7.2	6.4	6.1	5.1	4.7
English, General and Literature															
USA	7.5	7.6	7.6	7.4	7.1	6.6	6.2	5.6	4.9	4.2	3.7	3.4	3.1	2.9	2.7
Stanford	9.7	11.3	11.2	13.2	12.5	13.7	12.3	9.8	6.9	6.2	5.2	5.1	6.6	5.2	6.0
Philosophy															
USA	1.0	1.0	0.9	0.8	0.7	0.7	0.7	0.6	0.6	0.6	0.5	0.5	0.4	0.4	0.4
Stanford	1.7	1.4	1.3	1.5	1.7	1.5	1.0	1.5	1.2	1.2	1.3	0.8	0.9	1.1	0.5
Social Science Disciplines															
Anthropology															
USA	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.4	0.4
Stanford	1.1	1.7	1.6	2.2	3.0	3.6	3.3	4.4	2.9	2.1	1.7	1.3	1.2	1.2	0.7
Communication[2]															
USA	0.6	0.6	0.7	0.7	0.8	1.3	1.4	1.5	1.8	2.1	2.3	2.5	2.7	2.8	3.0
Stanford	1.3	1.8	1.7	2.4	2.2	2.6	3.4	3.5	4.2	5.2	4.3	4.9	3.1	4.2	3.6
Economics															
USA	2.2	2.3	2.4	2.3	2.2	1.9	1.7	1.6	1.5	1.5	1.6	1.6	1.7	1.8	1.9
Stanford	8.6	8.7	9.7	7.7	5.7	8.9	8.1	5.7	8.2	11.4	11.3	12.5	12.6	13.3	11.2
Political Science															
USA	2.9	3.1	3.2	3.2	3.2	3.3	3.2	3.2	3.2	3.2	3.0	2.9	2.8	2.8	2.7
Stanford	8.7	9.1	12.3	12.1	13.2	10.7	9.3	8.5	7.1	6.8	6.6	6.7	6.6	5.7	7.3
Psychology															
USA	3.2	3.4	3.7	3.9	4.1	4.4	4.8	5.0	5.4	5.4	5.3	5.0	4.7	4.5	4.5
Stanford	7.3	8.3	9.4	12.0	12.3	12.8	12.1	12.1	12.7	12.9	10.0	7.7	7.1	4.9	6.1

Table 2 (continued)
page 2
Bachelor's Degrees Granted, USA and Stanford

	1965-66	1966-67	1967-68	1968-69	1969-70	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79	1979-80
Social Science Disciplines (cont.)															
Sociology															
USA	2.9	3.2	3.5	3.6	3.9	4.0	4.0	3.9	3.8	3.4	3.0	2.7	2.5	2.2	2.1
Stanford	1.5	1.6	1.1	1.9	2.4	2.0	2.4	1.5	1.2	1.2	0.8	0.6	0.7	1.3	0.9
Natural Science Disciplines															
Biology, General															
USA	3.2	3.2	3.3	3.2	3.1	3.1	3.1	3.4	3.8	4.2	4.4	4.3	4.1	3.9	3.6
Stanford	6.4	8.1	7.0	6.7	8.5	7.7	9.5	9.1	11.8	12.2	14.2	11.3	10.6	11.0	10.6
Chemistry															
USA	1.9	1.8	1.7	1.6	1.5	1.3	1.2	1.1	1.1	1.1	1.2	1.2	1.2	1.2	1.2
Stanford	2.3	1.6	1.7	1.0	1.2	1.3	1.3	1.7	1.8	1.9	1.7	2.5	1.7	1.4	2.1
Mathematics and Statistics															
USA	3.8	3.8	3.7	3.7	3.5	2.9	2.7	2.5	2.3	2.0	1.7	1.5	1.4	1.3	1.2
Stanford	4.8	3.4	4.0	3.6	3.4	4.0	1.9	2.2	2.3	1.6	1.1	1.3	0.9	0.9	0.7
Physics															
USA	0.9	0.8	0.8	0.7	0.7	0.6	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Stanford	2.0	2.0	2.4	1.5	1.3	1.1	1.2	1.4	0.8	1.4	1.1	1.0	1.4	0.9	1.6
Interdepartmental Disciplines															
American Studies															
USA	0.14	0.12	0.13	0.15	0.15	0.18	0.19	0.19	0.19	0.19	0.18	0.18	0.16	0.14	0.14
Stanford	-	-	-	-	-	-	-	-	-	-	0.1	0.5	1.1	1.5	1.8
International Relations															
USA	0.17	0.18	0.17	0.15	0.14	0.14	0.13	0.12	0.13	0.11	0.13	0.13	0.15	0.17	0.18
Stanford	-	-	-	-	-	-	-	-	-	-	0.9	1.3	2.9	4.3	4.7
Linguistics/Human Languages															
USA	0.02	0.02	0.02	0.03	0.03	0.04	0.03	0.04	0.04	0.04	0.05	0.06	0.06	0.06	0.06
Stanford	-	-	-	-	-	-	-	-	-	0.06	0.71	0.60	0.36	0.37	0.43
Engineering Disciplines															
Chemical Engineering															
USA	0.5	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.3	0.3	0.4	0.5	0.6	0.7
Stanford	0.6	0.1	0.8	1.0	0.3	0.5	0.4	0.8	0.4	0.6	0.6	1.0	1.6	1.1	2.0
Civil Engineering															
USA	1.0	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.9	1.0	1.1	1.1
Stanford	1.4	1.7	1.5	1.3	1.0	1.1	1.1	1.8	1.8	1.6	1.3	2.7	2.0	2.1	2.2

Table 2 (continued)
page 3
Bachelor's Degrees Granted, USA and Stanford

	1965-66	1966-67	1967-68	1968-69	1969-70	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79	1979-80
Engineering Disciplines (cont.)															
Electrical Engineering															
USA	2.1	1.9	1.7	1.6	1.5	1.5	1.4	1.3	1.2	1.1	1.1	1.1	1.2	1.2	1.5
Stanford	3.6	2.4	2.6	1.8	2.0	2.6	1.9	2.0	1.8	2.3	2.4	3.3	3.3	4.1	3.7
General Engineering															
USA	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4
Stanford	1.2	1.0	1.2	1.2	1.5	1.3	1.2	0.9	0.5	0.2	0.8	0.7	0.7	1.2	0.8
Industrial Engineering															
USA	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.2	0.2	0.3	0.3	0.3
Stanford	1.3	1.3	1.1	1.2	1.1	0.9	0.9	0.8	0.9	0.6	1.3	1.3	2.8	2.7	2.3
Mechanical Engineering															
USA	1.5	1.4	1.2	1.2	1.2	1.1	1.0	0.9	0.8	0.7	0.7	0.8	1.0	1.1	1.3
Stanford	1.5	2.4	1.7	1.3	1.2	1.4	1.3	0.9	0.8	0.7	1.2	2.8	3.2	2.7	3.4
Earth Science Disciplines															
Applied Earth Sciences															
USA	0.04	0.04	0.03	0.05	0.06	0.08	0.09	0.10	0.13	0.11	0.12	0.12	0.12	0.11	0.10
Stanford	0.1	0	0.1	0.1	0	0	0	0.1	0.1	0.2	0.3	0.8	0.5	1.1	1.0
Geology															
USA	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.5	0.5	0.5
Stanford	0.8	0.7	0.3	0.5	0.7	0.4	0.4	0.7	0.9	0.8	0.9	0.8	1.3	1.1	1.3
Geophysics															
USA[3]	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Stanford	0.14	0.07	0	0.07	0.21	0.27	0.12	0.06	0.18	0.12	0.24	0.18	0.12	0.18	0.43
Petroleum Engineering															
USA	0.02	0.02	0.03	0.03	0.04	0.03	0.03	0.03	0.04	0.03	0.04	0.04	0.06	0.08	0.09
Stanford	0.21	0.20	0.13	0	0.28	0.13	0.06	0	0.12	0	0.12	0.12	0.54	0.43	0.37

Notes

[1]USA category altered in 1970-71 to exclude some technical trades.

[2]Prior to 1970-71, USA category included journalism only.

[3]Percentage too small to be shown in table.

TABLE 3

COMPARISON OF TRENDS IN BACHELOR'S DEGREES,
STANFORD AND USA, 1965-66 TO 1979-80

SIMILAR TRENDS

DISCIPLINES/DEPARTMENT(S)	PEAK YEAR(S)*		BOTTOM YEAR(S)*	
Declining	USA	SU	USA	SU
Fine and Applied Arts	76-77	71-73		
English (general)	67-68	70-71		
History	68-69	64-65**		
Anthropology	73-74	72-73		
Sociology	70-72	71-72		
Political Science*	74-75	69-70		
Psychology	73-75	73-75		
Biology	75-76	75-76		
Mathematics*	65-67	65-66		
Gaining				
Chemical Engineering*			74-76	75-76
Civil Engineering			74-75*	69-72
Electrical Engineering*			74-77	73-74
Industrial Engineering			75-77	74-75
Mechanical Engineering			74-76	73-75
Geology*			(none)	71-72
Petroleum Engineering*			76-77	77-78

DISSIMILAR TRENDS

DISCIPLINES/DEPARTMENT(S)	DISSIMILARITY
Languages	Decline in USA since 68-69; decline at Stanford since 76-77.
Communication	Gains in USA; growth at Stanford until 1974-75, then modest decline.
Economics	Gains in USA to 67-68, decline to 73-74, recovery; constant at Stanford until gains beginning in 75-76.
Chemistry	Decline in USA to 73-74, recovery; mostly constant at Stanford.
Physics	Steady decline in USA; mostly constant at Stanford after decline in 1968-69.
General Engineering	Gradual gains in USA; mostly constant at Stanford.
Applied Earth Sciences	Decline in USA after 73-74; gains at Stanford after 74-75.

*For disciplines or departments that did not have peak or bottom years we give the dates after which a rising or falling trend began.

**Based on data not shown in Table 2.

TABLE 4

ENROLLMENTS PER DEGREE RECIPIENT IN SELECTED DEPARTMENTS AND PROGRAMS*

Department/Program	1975 - 76	1976 - 77	1977 - 78	1978 - 79	1979 - 80	1980 - 81	1981 - 82	Mean
Humanities								
Art	1.32	1.33	1.44	1.54	1.44	1.30	1.27	1.37
English	2.46	2.82	2.72	2.94	3.02	3.05	2.85	2.83
French/Italian	1.28	1.25	1.31	1.35	1.42	1.49	1.59	1.38
History	1.67	1.80	1.81	1.76	1.57	1.67	1.52	1.68
Music	1.65	1.61	1.55	1.27	1.38	1.08	1.30	1.40
Social Sciences								
Anthropology	0.57	0.61	0.56	0.64	0.70	0.63	0.52	0.60
Economics	2.17	2.41	2.42	2.55	2.45	2.78	2.72	2.50
Political Science	1.48	1.70	1.76	1.76	1.93	2.00	2.09	1.82
Psychology	3.46	3.35	3.09	3.00	2.91	2.32	2.54	2.95
Natural Sciences								
Biology	2.49	2.37	2.31	2.19	2.27	2.11	1.97	2.24
Chemistry	2.12	2.52	2.38	2.23	2.44	2.26	2.46	2.34
Mathematics	2.10	2.56	2.51	2.56	2.52	2.51	2.67	2.49
Physics	1.54	1.87	1.90	1.84	1.97	1.73	2.05	1.84
Interdepartmental								
Human Biology	1.50	1.75	1.81	2.07	2.00	2.18	2.21	1.93
Engineering								
Civil	0.39	0.74	0.60	0.59	0.70	0.73	0.62	0.62
Electrical	0.56	0.83	0.75	0.87	0.84	0.92	0.85	0.80
General	0.62	0.97	1.11	1.11	1.11	1.24	1.32	1.07
Industrial	0.32	0.40	0.68	0.66	0.71	0.77	0.87	0.63
Mechanical	0.39	0.67	0.79	0.70	0.69	0.82	0.74	0.69
Earth Sciences								
Geology	0.50	0.53	0.64	0.63	0.69	0.63	0.58	0.60
No. of Graduates	1675	1626	1638	1599	1606	1583	1650	1625.3

*Figures given are total course enrollments in the respective departments or programs divided by the number of graduates in the university.

FIGURE 1
BACHELOR'S DEGREES GRANTED BY SCHOOL DIVISION
1960-61 TO 1981-82

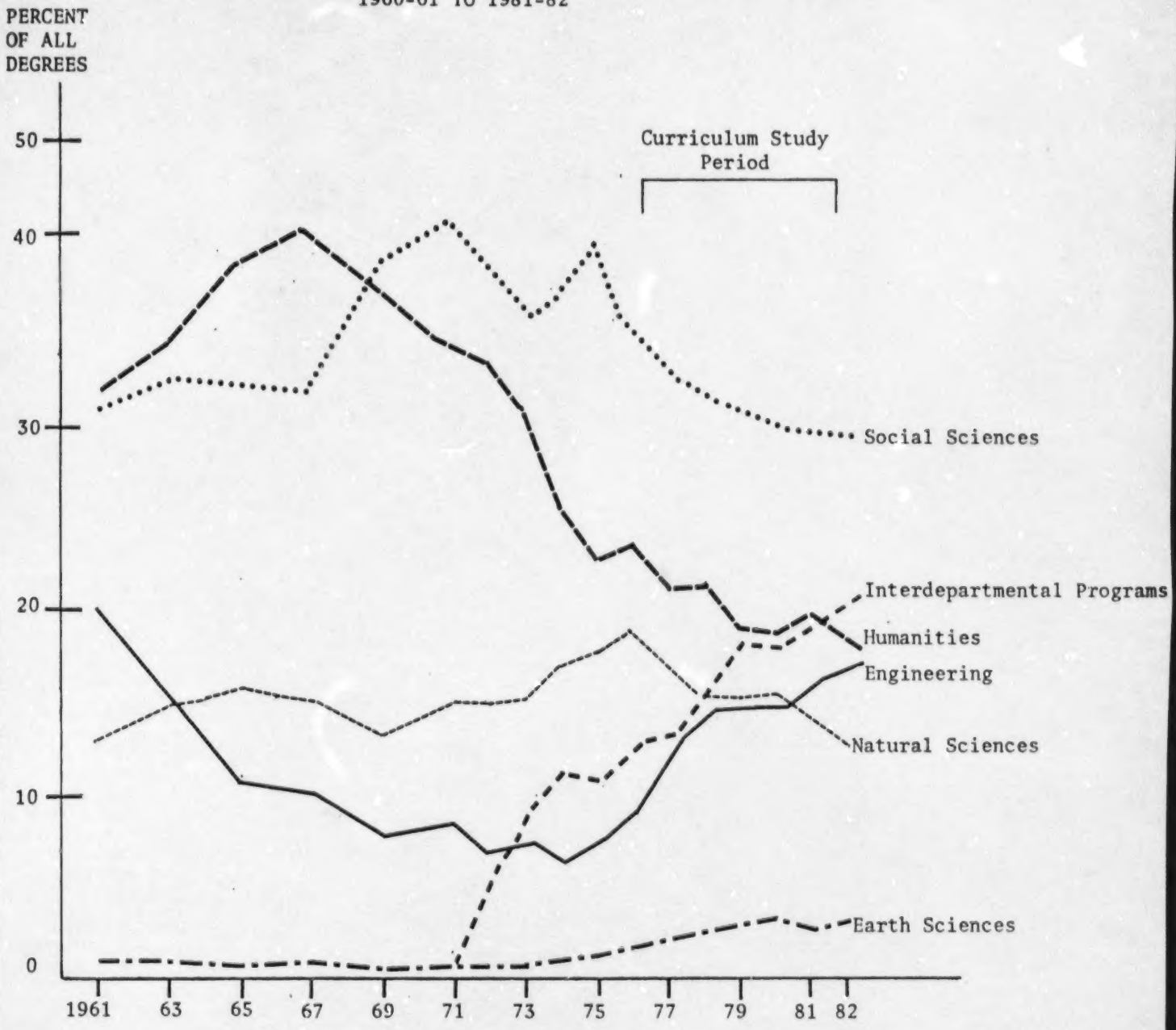

FIGURE 2
ENROLLMENTS PER DEGREE RECIPIENT
BY SCHOOL DIVISION, 1975-76 TO 1981-82

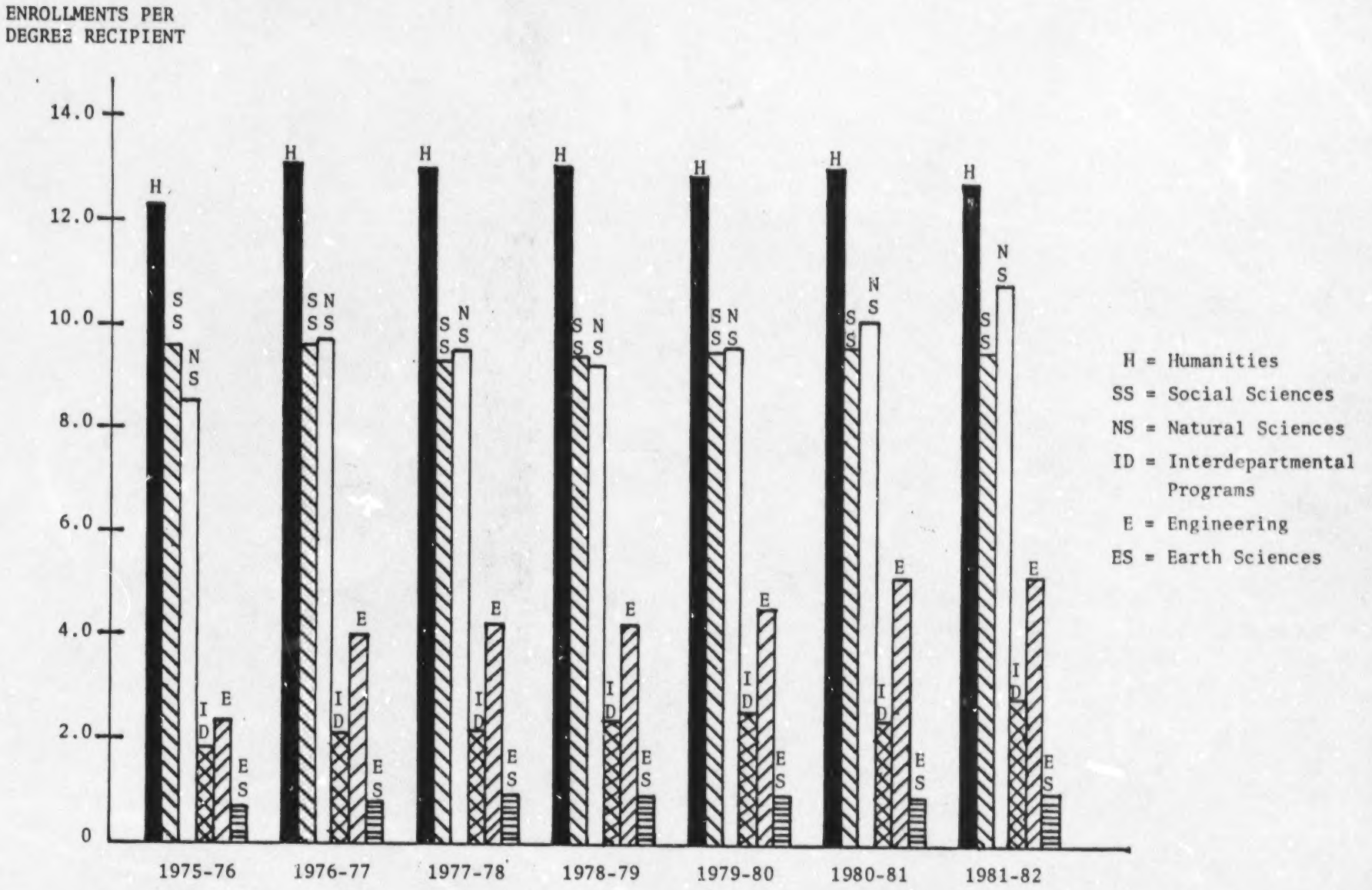

FIGURE 3
SOURCES OF COURSE ENROLLMENTS BY SCHOOL DIVISION,
1975-76 and 1981-82